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WinHSPF

Version 2.0

An Interactive Windows Interface to HSPF (WinHSPF)

User's Manual

P. Duda, J. Kittle, Jr., M. Gray, P. Hummel, R. Dusenbury

AQUA TERRA Consultants
Decatur, Georgia

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Work Assignment Manager

R. Kinerson

*Health Protection and Modeling Branch
Standards and Health Protection Division
Office of Science and Technology
Office of Water
United States Environmental Protection Agency
1200 Pennsylvania Ave, NW
Washington, DC 20460*

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WinHSPF replaces the program NPSM developed for BASINS 1.0 and 2.0 by Tetrattech, Inc. Many features of WinHSPF were inspired or influenced by that earlier product.

User Assistance and Technical Support

EPA's Office of Science and Technology (OST) provides assistance and technical support to users of WinHSPF. Technical support can be obtained at OST's Internet Home Page. WinHSPF users are encouraged to access OST's home page for information on new updates, answers to the most frequently asked questions, user tips, and additional documentation.

EPA OST's Internet home page address: <http://www.epa.gov/ost/basins>

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Abstract

Hydrologic and water quality modeling with the Hydrological Simulation Program-Fortran (HSPF) involves managing large volumes of data. Among that data are parameters describing watershed characteristics, which often are derived from Geographic Information Systems (GIS) layers such as subbasin boundaries and land uses. Other parameters specify simulation options within HSPF. All of these parameters are input to HSPF by means of a text file, known as the User Control Input (UCI) file, containing a series of tightly formatted records. The values on the records must be formatted precisely, and the records must themselves be arranged in a preordained order for HSPF to understand.

WinHSPF was designed as an interactive Windows interface to HSPF. WinHSPF assists the user in building UCI files from GIS data, especially data from the US Environmental Protection Agency's BASINS system. After the UCI file is built, WinHSPF is used to view, understand, and modify the model representation of a watershed. The Fortran program HSPF can be run from within WinHSPF. A given UCI file can be modified and saved by another name, thus creating model simulation scenarios. Within the BASINS system, WinHSPF is intended to be used in conjunction with the interactive program known as 'GENERation and analysis of model simulation SCeNarios', or GenScn. GenScn allows the user to analyze results of model simulation scenarios and compare scenarios.

Introduction

Purpose of Report

This manual assists both end users and system administrators with the interactive computer program WinHSPF. Following the introduction is a chapter entitled User's Guide. This chapter contains four sections. The first section is entitled User Interface. It provides guidance for navigating the graphical user interface. The next section includes an Overview of WinHSPF from a systems perspective. Included is information relating to the system hardware and software requirements, system architecture, and sample data provided. Following that section is a series of Tutorials designed to familiarize a user with getting around within WinHSPF. The last section of the User's Guide, Detailed Functions, provides more specifics about individual functions of modules of WinHSPF. This manual concludes with a list of references and an appendix containing descriptions of the four types of BASINS files used by WinHSPF.

Background

Use of the Hydrological Simulation Program-Fortran (HSPF) watershed model (Bicknell and others, 1997) traditionally involved using a text editor to build an input sequence to describe a watershed's physical and water management characteristics. For large, complex river basins, input sequences were often thousands of lines long when water quality was simulated in addition to the hydrology. The processes of building a new input sequence and making changes to an existing one were time consuming and complex. In addition, the physical abstraction of a watershed was not at all apparent from looking at the input sequence. It was difficult for a user to understand how the model representation of a watershed related to the watershed in the real world.

The development of WinHSPF came as a response to the need to make HSPF input sequences easier to build and modify. WinHSPF provides advanced interaction with the HSPF input sequence and graphical illustration of the model representation. WinHSPF was created for the US Environmental Protection Agency's BASINS system, although any HSPF user would benefit from its advanced input sequence modification functionality.

Capabilities and Uses

WinHSPF provides an interactive interface to HSPF in a Windows environment. WinHSPF may be used for creating a new HSPF input sequence or for modifying an existing HSPF input sequence. The program HSPF may be run from within WinHSPF. Input Sequences may be modified and saved under another name, thus creating simulation scenarios. WinHSPF also assists the user in building the necessary data sets and making the necessary modifications to the input sequence for hydrologic calibration using the United States Geological Survey's Expert System for the Calibration of HSPF (HSPEXP).

User's Guide

This user's guide provides:

- a description of how to use the forms and menus of the user interface;
- an overview of the system architecture, and sample data;
- a tutorial containing a set of lessons that shows the major features of WinHSPF; and
- a detailed description of the forms and menus for each major function in WinHSPF in (detailed functions).

User Interface

The majority of the user interface consists of standard Windows (95/98/NT/2000) components. All forms within the system are made up of varying numbers of menus, toolbars, buttons, lists, check boxes, radio buttons, command buttons, picture boxes, and text boxes. All mouse interaction is through the left mouse button. More detailed information on the objects that make up the forms may be found in the Windows on-line help. A few extensions to the Windows interface are used in WinHSPF, but these operate in a similar manner to Windows components.

Graphical User Interface Conventions

WinHSPF was developed for user interaction to take place through a graphical user interface (GUI). Screens are organized in a logical manner to minimize both user learning time and user mouse/keystroke effort. Information within WinHSPF is often organized in layers, with the most basic, important information being readily available and more detailed, less frequently used information being accessed through additional menus or buttons. Another way that information may be layered is through the use of overlaid tabs, with the most frequently used tabs on top of the stack.

WinHSPF was also designed to assist the user in keeping track of where they are in the system. This was done by labeling all of the sub forms with titles that indicate the task being performed. This labeling also confirms to the user that they got to the right place in the system after selecting a menu option or button. The label on the main form is updated to include the name of the project being run every time a project is opened.

Keyboard Shortcuts

To allow users the flexibility of not using a mouse, keyboard shortcuts have been provided to perform all of the functions throughout WinHSPF. Some controls, such as menus and buttons, may be activated by holding down the Alt key and then pressing the letter underlined in the control. Other controls may only be manipulated using keyboard shortcuts if the control has the "focus." Focus means that the control can receive keyboard or mouse input. Focus is indicated by a dashed line surrounding the control. When using the keyboard, the focus is changed from one control to the next by using the Tab key (a mouse sets the focus to the control on which it has clicked).

Menu titles may be activated by holding down the Alt key and then pressing the letter underlined in the desired menu title. Once a menu title has been activated (that is, pulled down), the desired menu item may be selected by pressing the underlined letter or by highlighting the item using the arrow keys and then pressing the Enter key. For example, to select the File:Open menu item, one would type ALT-FO.

Buttons may be activated in one of two ways. If a button caption has an underlined letter, holding down the Alt key and pressing the underlined letter will activate the button. A button may also be activated by setting the focus to the button and then pressing the Enter key.



In this picture, the **OK** button has a keyboard shortcut, indicated by the underline, so pressing **Alt-O** will activate the **OK** button as if it had been clicked with the mouse. The dashed line around the **Cancel** button indicates that button currently has focus, so pressing **Enter** will activate the **Cancel** button as if it had been clicked with the mouse. A button labeled **Cancel** can also be activated by pressing the **Esc** key.

Selection of list items is performed in different ways depending on the type of list. A scrollable list allows multiple items to be selected. To select items in a scrollable list, set the focus to the list, use the arrows to set the focus to the desired item, and then press the space bar to highlight the item. A drop-down list allows only one item from a list to be selected. To select the desired item from a drop-down list, set the focus to the list and use the arrow keys to highlight the desired item.

Selection of option buttons and check boxes may be made in two ways. If an option button or check box caption has an underlined letter, holding down the **Alt** key and pressing the underlined letter will select the item. Option buttons and check boxes may also be selected by setting the focus to them and using the arrow keys to highlight the desired item. For option buttons, this will automatically select the button. For check boxes, the space bar must be pressed to select the highlighted item.

If a form contains layered tabs of information, a tab may be moved to the front by holding down the **Alt** key and pressing the underlined letter in the caption of the desired tab.

Toolbars

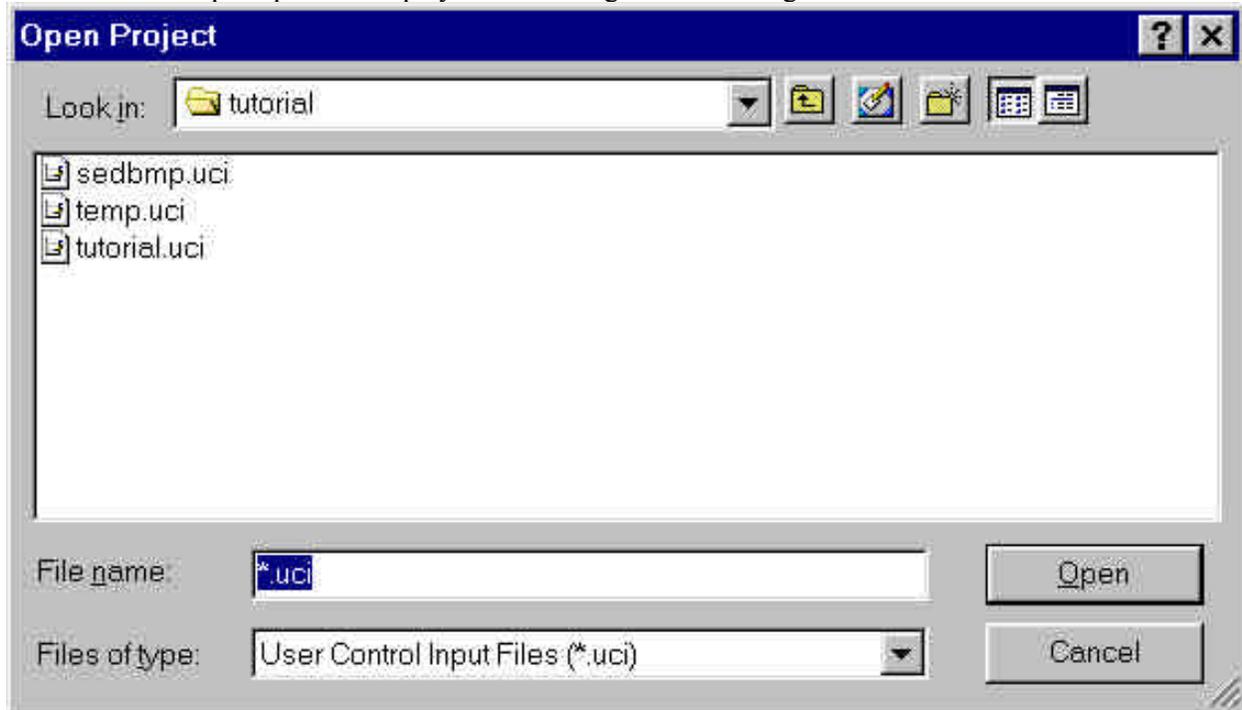
Toolbars are used in WinHSPF to provide quick access to the most frequently used functions. When applicable, the toolbars are located in close proximity to the control(s) with which their functions are associated. This allows a single click of a nearby button to perform a function, rather than moving to the top of the form to pull down a menu title and select a menu item. The toolbar buttons contain graphical images to assist the user in recalling what each button does. Additionally, toolbar buttons contain tooltips, which provide a text description of each button when the mouse pointer is held over the button for a brief moment.

Common Dialogs

Some interactions that are routinely performed in the Windows interface are handled using common dialogs. These are forms that have consistent interfaces for routine tasks. The user will then be familiar with the form each time one of these tasks are performed. Within WinHSPF, the tasks performed using common dialogs are retrieving or saving a file.

In WinHSPF, the user is frequently prompted for file names when saving or retrieving a file. The list at the top of the form (labeled either **Save in** or **Look in**) displays the current directory path. Use of the pull-down arrow on this list allows the user to move to any directory above the current one. Directories below the current one are displayed in the large middle box. The desired directory is selected by double clicking on it. The buttons to the right of the top list are used for (from left to right) moving up one directory level,

viewing the root desktop directory, creating a new directory (or folder), and specifying whether to display a standard or detailed list of the directories and files contained in the current directory. The middle box also displays any existing files of the file type specified. The file type specification is made in the list at the bottom of the form (labeled either **Save as type** or **Files of type**). The **File name** text box is used to enter the name of the file. Clicking on a file listed in the middle box will put the name of the file in the **File name** box. A file is selected either by double clicking a file name in the middle box or by filling in the **File name** box and clicking the **Save** button or the **Open** button. Selecting an existing file during a save will cause a prompt to be displayed confirming that it is all right to overwrite the file.



Help System

There are various levels of Help within WinHSPF and they may be accessed in different ways. The Help menu title on the main WinHSPF form has two menu items: About and Contents. The About item is used to display a summary of the version of WinHSPF being run. The Contents item is used to bring up a window that allows the user to move throughout the entire WinHSPF help file. The user may move through the help file by using the hierarchical structure or the index of help topics.

Context-sensitive access to the WinHSPF help file is provided through the F1 key. Pressing the F1 key from any form will display the relevant topic in the help file.

An additional level of help that pertains to HSPF is also available. This help information is available when editing a table of the HSPF UCI file. Help will be displayed that pertains to the model parameter being edited.

System Overview

This section includes information relating to the system hardware and software requirements, downloading the program and documentation, architecture, special files, and sample data.

System Requirements

WinHSPF requires a computer running Windows 95/98, Windows NT Version 4.0 or higher, or Windows 2000. The minimum platform configuration is a Pentium or equivalent processor running at 200 megahertz with 64 megabytes of memory, at least 100 megabytes of free disk space, and display resolution of at least 1024 x 768. For optimal performance, a Pentium II processor running at 400 megahertz or faster with at least 128 megabytes of memory, 100 megabytes of free disk space, and display resolution of 1280x1024 is recommended. A color printer is also recommended.

Obtaining WinHSPF

WinHSPF may be obtained through the internet by accessing the US Environmental Protection Agency's BASINS page. From this page follow the instructions for downloading the software and installing it on your machine. The manual, containing the same text and figures found in the help file, is included with the software.

Architecture

Object design was key in development of WinHSPF. An object was created to store all of the information that is normally contained within the UCI file. This UCI object is accessible throughout WinHSPF, and enables the software to easily access model parameter values. All of the data traditionally stored in the UCI file are now stored in the UCI object in memory. When the user accesses an existing UCI file, the UCI file is read and translated into the UCI object. WinHSPF then uses this UCI object throughout the program. When the UCI information is saved, the contents of the UCI object are translated back into the UCI file format.

The HSPF model code was compiled into a dynamic link library (dll) for access by WinHSPF. A small set of subroutines was developed to interface between the Visual Basic code and the existing HSPF Fortran routines. Similarly, the timeseries data objects within WinHSPF use some calls to the Watershed Data Management (WDM) Fortran library of subroutines for time-series management. This scheme allowed the well-tested and well-documented WDM code to be preserved.

BASINS Files

WinHSPF uses a series of files from BASINS for creating a new project. These files are intended to be produced using the BASINS GIS interface, but since they are text files, they may be built manually. Once a new project has been created, these files will no longer be needed by the project.

The following sections provide detailed descriptions of each of these files and their contents. For examples of these files, see BASINS File Samples within the Appendix. The following is a list of the files:

- Watershed File - *.wsd
- Reach File - *.rch
- Channel Geometry File - *.ptf
- Point Sources File - *.psr

Watershed File

The Watershed File has a .wsd extension. This file contains information related to the amount of each land use contributing to each reach. This file is written from BASINS and is used in creating a new WinHSPF project.

The Watershed File is a space-delimited ASCII file, with one or more spaces used to separate fields. Each record of the file contains the following information:

- LU Name (land use name, used as LSID in PERLND/IMPLND GEN-INFO table)
- Type (1=impervious/2=pervious, used to specify PERLND vs IMPLND)
- Watershed-id (used to connect each land use to a reach)
- Area (in acres, used as area factor in SCHEMATIC block)
- Slope (used as SLSUR in PERLND PWAT-PARM2/IMPLND IWAT-PARM2 table)
- Distance (in ft, used as LSUR in PERLND PWAT-PARM2/IMPLND IWAT-PARM2 table)

An example of the Watershed File is found in the Watershed File section of the Appendix.

The Slope and Distance fields are derived from the fields 'Slo1' and 'Len1', respectively, in the Subbasins shape file. These values are computed during watershed delineation.

Reach File

The Reach File has an .rch extension. This file contains information related to each reach and the connections between reaches. This file is used in creating a new WinHSPF project.

The Reach File is a space-delimited ASCII file. Each record of the file contains the following information:

- Rivrch (reach id)
- Pname (reach name, used as RCHID in RCHRES GEN-INFO table)
- Watershed-ID (used to connect each reach with associated land segments)
- HeadwaterFlag
- Exits (number of exits, used as NEXITS in RCHRES GEN-INFO table)
- Milept
- Stream/Reservoir Type (S-stream/R-reservoir, used to set LKFG in RCHRES GEN-INFO table)
- Segl (segment length in miles, used as LEN in RCHRES HYDR-PARM2 table)
- Delth (delta h in ft, used as DELTH in RCHRES HYDR-PARM2 table)
- Elev
- Ulesm
- Urcsm
- Dscsm (downstream reach id, used to establish connectivity for SCHEMATIC block)
- Ccsm
- Mnflow
- Mnvelo
- Svtnflow
- Svtnvelo
- Pslope
- Pdepth
- Pwidth

- Pmile
- Ptemp
- Pph
- Pk1
- Pk2
- Pk3
- Pmann
- Psod
- Pbgdo
- Pbgnh3
- Pgbod5
- Pgbod
- Level

Many of the fields in this file are not used by WinHSPF. Those fields that are used by WinHSPF are noted above.

An example of the Reach File is found in the Reach File section of the Appendix.

Channel Geometry File

The Channel Geometry File has a .ptf extension. This file contains information related to the channel cross sections and lengths for each reach. This file is used in creating the FTABLES for a new WinHSPF project.

The Channel Geometry File is a space-delimited ASCII file. Each record of the file contains the following information:

- Reach Number
- Length (ft)
- Mean Depth (ft)
- Mean Width (ft)

- Mannings Roughness Coeff.
- Long. Slope
- Type of x-section
- Side slope of upper FP left
- Side slope of lower FP left
- Zero slope FP width left (ft)
- Side slope of channel left
- Side slope of channel right
- Zero slope FP width right (ft)
- Side slope lower FP right
- Side slope upper FP right
- Channel Depth (ft)
- Flood side slope change at depth
- Max. depth
- No. of exits
- Fraction of flow through exit 1
- Fraction of flow through exit 2
- Fraction of flow through exit 3
- Fraction of flow through exit 4
- Fraction of flow through exit 5

An example of the Channel Geometry File is found in the Channel Geometry File section of the Appendix.

Point Sources File

The Point Sources File has a .psr extension. This file contains information related to point source dischargers in the watershed, the pollutants output and the loading rates. This file is used in creating point source time-series data sets in the project WDM file.

The Point Sources File is a space-delimited ASCII file. The first record of the file contains an integer number of point source dischargers. Following this line is a blank line, followed by a header line. Then the next n lines, where n is the number of point source dischargers, contain the following information:

- Facility Name
- Npdes
- Cuseg
- Mi

The following line is blank, followed by a header line. The rest of the file consists of a series of records containing the following information:

- Ordinal Number
- Pollutant
- Load (lbs/hr)

An example of the Point Sources File is found in the Point Sources File section of the Appendix.

Sample Data

Sample data have been provided with the WinHSPF installation package for learning and demonstration purposes. No assumptions are to be made concerning the accuracy of the data, including the HSPF User Control Input (UCI) file that might be created from this test data.